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Paratyphoid (Salmonella) Infection of Calves in Kenya.*

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During recent years attention has been directed to the excessive mortality obtaining among calves of the age of from three weeks to three months in many of the dairying herds of Kenya. The disease from which the majority of these calves die is frequently known colloquially as "black scour," although a considerable percentage of the infected animals fail to show diarrhœa as a prominent symptom. On certain farms the losses have been attributed to anaplasmosis, since it is at about this age that the majority of undipped calves contract anaplasmosis by natural infection. Recent investigations on a particularly heavily infected farm have shown that although many of the calves are infected at death by *Anaplasma marginale*, others fail to show *anaplasma* in blood smears taken during the period of illness and at death. Bacteriological investigations indicate that the mortality is due to a paratyphoid infection, not infrequently co-existent with anaplasmosis.

Numerous observations have been made on the occurrence of paratyphoid infection of calves, particularly in Europe. The first notices in Literature appear to have been those of Thomassen (1897) and Poels (1899). It was Poels who suggested the rather unfortunate term "pseudocoli-bacillosis" for this disease. A more complete description of the disease is given by Jensen (1913) under the title "paracoli-bacillosis." Jensen states that the infection is characterised by enteritis, hæmorrhagic inflammation of the mesenteric glands, tumor splenis, and sero-fibrinous exudates from the serous membranes. In certain cases he is doubtful about the possibilities of infection by the navel. In older calves and in young adult cattle Jensen states that the disease may be predominantly either an enteritis or a pneumonia, or a combination of the two conditions.

Christiansen (1913) observed 222 cases of paratyphoid infection in calves and gives an analysis of the ages of the affected animals; the greater number of his cases were more than two weeks old. He also states that lung lesions were present in 144 calves out of the 222 examined. Poels, on the other hand, states that the common age of infection is from five to eight days and that the most frequently occurring lesions are nephritis and urocystitis.

Meyer, Traum and Roadhouse (1916) studied a small outbreak in hand-reared calves in the U.S.A. Ten calves out of thirty-four under observation died from infectious diarrhœa, and paratyphoid bacilli were isolated from the organs of the animals that were examined *post-mortem*. The youngest of these calves was twenty-four days old and the oldest eighty-seven days old; the average age at death was approximately thirty-nine days. These authors point out that the age of the calves affected is a fairly valuable criterion for the differential diagnosis of paratyphoid infection and ordinary *B. coli* infection or common white scour, but that since infections with *B. proteus*, *B. pyocyaneous* and other organisms may occur up to one month old, a bacteriological examination is necessary to establish a definite diagnosis.

Schermer and Ehrlich (1921) recall the observations of Karsten and of Wiemann on the occurrence in Holstein and East Prussia of a paratyphoid infection of calves, most frequently associated with the presence of lung lesions. Other lesions observed were tumor-splenis, necrotic foci in the liver, and catarrhal enteritis. The commonest lesions are said to be those of lung and intestine. The lung changes consist of dark red hepatization of the anterior and middle (cardiac) lobes of lung and less frequently the development in the same areas of small necrotic foci. Stickdorn is stated to have observed lung lesions in fifty-six cases out of 170. Schermer and Ehrlich saw twenty calves on one farm with pneumonia and diarrhœa. The calves were treated with calf dysentery serum and pneumonia serum, but no improvement was observed. On *post mortem* examination lesions were found in the anterior and middle lobes of the lung. The affected portions of lung were of a consistency resembling spleen. The small intestine was congested and its mucous membrane slightly swollen. The spleen was unchanged. From all the organs paratyphoid bacilli were obtained in culture. These organisms agglutinated with Gærtner serum and with Copenhagen calf-paratyphoid serum to the maximum titre, with para B serum not at all, and with Typhus serum only in the lowest dilutions. In another case, one calf examined from premises where six calves had died showed lung lesions. The spleen was again unchanged. From the organs of this calf the Gærtner type of organism was again cultivated.

Pfenniger (1924) in his discussion on white scours in calves refers to the disease under the heading of the "Paracolon Bacillus" and states that most of the strains of bacilli isolated belong to the Gærtner group, while a few may be identical with *B. paratyphosus* "*B*" (Schnott-muller). He points out that bacteriological diagnosis is essential before appropriate treatment of an enzootic can be undertaken.

Turning now to records of the disease from Africa, Bevan (1908) has described a disease of calves, in the neighbourhood of Salisbury, in which a fœtid diarrhœa is accompanied by pneumonic changes in the lung. Attempts to isolate the causal organism were unsuccessful. An examination of the clinical features and lesions described by Bevan leaves little doubt, however, that he was dealing with paratyphoid infection.

Robertson (1907), according to Bevan, has also described a pneumo-enteritis of calves in the Eastern Coastal Districts of Cape Colony, said to be due to *Pasteurella bovis*.

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Since this paper has been under preparation, a manuscript copy of a paper on Paratyphoid Infection of Calves in South Africa, by Viljoen and Martinaglia, has been received. The paper in question was read before the July meeting of the South African Association for Advancement of Science and will be published in the Annual Volume of that Association about January, 1927.

Viljoen and Martinaglia recall that a disease of calves was described by Henning under the name of "yellow liver," but that no bacteriological investigations were attempted. Considerable stress is laid by Viljoen and Martinaglia upon predisposing conditions, which they state are of the utmost importance. The conditions to which they refer are briefly: *Locality*—Low-lying warm districts; *Climate*—Summer after heavy rains; *External Parasites*—Piroplasmosis, anaplasmosis and heartwater; *Dairying*—Prolonged fasting of calves and daily concentration in unhygienic pens. All the conditions mentioned may operate in certain parts of Kenya and their bearing on the incidence of the disease has been appreciated and will be discussed.

Symptoms of Paratyphoid Infection.

The first symptoms noticed by the herd are usually dulness and inappetence. The calf is disinclined to move, the coat is staring, and there is little or no appetite. The temperature is found to be high, from 104° to 107°, and observation generally shows that the calf is constipated. There are occasional evidences of abdominal pain, and if the case is uncomplicated by *anaplasma* infection the visible mucous membranes are dark and injected.

During the first two or three days of illness the temperature remains consistently high throughout the day, but on the third or fourth morning there is a remission, followed by an evening rise. From this time onward daily morning remissions are usually fairly well-marked until shortly before death or complete recovery. The constipation, noticeable in the initial stages of the disease, not infrequently gives place in a few days to diarrhœa, in which the fæcal matter is commonly very dark brown or almost black. Blood and mucus may be present in the fæces during the attack of diarrhœa. The affected calf may continue to scour right up to the time of death or may again become constipated after a few days, in some instances suffering alternating periods of constipation and diarrhœa, in others remaining quite free from any sign of scour.

A few days after the onset of symptoms there may be a more or less profuse mucous discharge from the eyes and nostrils. When lung lesions develop there is usually a harsh dry cough, and areas of dulness may be detected towards the anterior lobes of the lungs.

There is considerable variation in the course of the disease, as observed in a number of calves on the same farm. A few very acute cases are seen in which the duration of the disease, from the first noticed symptoms to the time of death, is but a matter of hours. In the majority of cases the period of illness is usually some four to nine days. Less acute cases, however, may die after an illness extending over three weeks or more. In the more chronic cases lung lesions are almost invariably a prominent feature. The mortality among affected calves is rarely less than 80 per cent. and on heavily infected farms very few recoveries are ever observed.

In cases that are complicated by the co-existence of anaplasmosis, jaundice and anæmia may be noticeable symptoms.

Lesions.

The commonest lesion observed at *post-mortem* examination appears to be a more or less pronounced *cholecystitis*. The bile is very rarely found to be normal in colour or consistency. Its colour varies from a rather opaque pale golden yellow to a fairly deep chocolate instead of the normal olive green, while its consistency varies from that of ordinary golden syrup to that of a thick dark, partly inspissated flaky cream. The wall of the gall-bladder is generally noticeably thickened, its mucous membrane swollen and roughened.

In Kenya, lung lesions and *tumor splenis* are each observed in about 50 per cent. of the carcases examined. The lesions in the lung are chiefly confined to the anterior or apical and the cardiac lobes, with occasional involvement of the anterior portions of the main lobes. These parts of the lung may in early cases be in a state of red hepatisation; later the condition appears to be grey hepatisation with the development of small necrotic foci up to the size of an ordinary pea. A greyish serous exudate is easily expressed from the smallest bronchioles. The necrotic foci may be so numerous as to give the lung a putrid appearance and there may be a pronounced putrefactive odour. There may be a localised fibrinous pleurisy. The spleen may be considerably enlarged and its contents semi-fluid.

The liver (even in cases uncomplicated by anaplasmosis) is frequently enlarged and its border rounded off. Its colour may vary from normal to a rich golden brown, like that of Spanish mahogany. What are apparently small necrotic foci may be present in the liver; Joest has shown, however, that these white spots have in reality more the histological structure of tubercles than of areas of necrosis.

The intestine frequently shows areas of congestion, principally in the ileum, and first portion of the large intestine. The mucous membrane of the affected portion of gut may be swollen and deeply hæmorrhagic, but ulcers have not been observed. Frequently also the mesenteric glands above the inflamed portions of gut are considerably swollen and intensely hæmorrhagic.

A few petechiæ are not uncommonly observed on the epicardium and occasionally a small quantity of clear exudate is present in the pericardial sac.

Kidney lesions in the form of small necrotic foci or tubercles are extremely rare in the cases examined in Kenya.

The remaining organs are unchanged unless cases are complicated by redwater or anaplasmosis.

Diagnosis.

Cultivation of the Bacillus from the circulating blood.

During the first period of pyrexia, *i.e.*, before the first morning remission in temperature, there is almost always bacteræmia and the disease may be diagnosed by cultivation of the organism from the circulating blood. Cultures may be made in ordinary beef bouillon or in Cumming's special medium. The latter medium consists of sod.

taurocholate 0·5 per cent. *plus* sod. citrate 1 per cent. in distilled water. The laboratory now makes a practice of supplying this medium in small rubber-capped bottles for the collection of blood. Blood is drawn by syringe from the jugular vein and the needle of the syringe is inserted through the rubber cap to inoculate the medium. The bottle may then be packed and despatched to the laboratory by post in the ordinary manner.

After the first morning remission in temperature it usually becomes impossible to obtain a positive blood culture until shortly before death when the bacilli are again present in the blood stream.

Cultivation from Fæces.

In about 40 per cent. of positive cases it has been possible to cultivate the causal organism from the fæces during life. Cultivation from the fæces is more frequently successful in the earlier stages of the disease. The technique employed has been the brilliant green method of Browning followed by plating on McConky's medium. It is usually possible to obtain a pure culture direct from one of the brilliant green dilutions, although amounts of brilliant green somewhat in excess of those recommended by Browning must be used.

Agglutination of the Bacillus by Sick Calves.

Affected calves that have been sick for periods in excess of six days, as a rule strongly agglutinate the Paratyphoid bacillus, providing a readily agglutinable culture is employed for the test. The agglutination titre of sick calves varies from 1:200 to 1:2500. No agglutination is obtained with normal sera or with the sera of calves suffering from other diseases such as "white scour." Sera of affected calves do not agglutinate any other members of *Salmonella* group, *Bacillus enteritis gærtner* excepted.

These three methods constitute the available means of diagnosis during life, although it is advisable to take daily blood smears during the period of sickness in order to ascertain whether there is any intercurrent infection with anaplasmosis.

POST-MORTEM DIAGNOSIS.

The lesions encountered on *post-mortem* examination of calves dying from paratyphoid infection are fairly characteristic but by no means diagnostic, since it is not unusual to find lung lesions resembling those of paratyphoid in cases of *Bacillus coli* septicæmia following chronic white scour.

It is always possible to cultivate the bacillus from certain of the organs and usually from the blood-stream of fresh carcases. In nearly every case cultivation from the bile is successful, generally giving a pure culture, but in a few cases colonies of *B. coli* also appear on the plate. The organism may also be cultivated in most cases from the liver, and less certainly from one of the mesenteric glands. It has also been obtained from pleuritic exudates, from the spleen, from the kidneys, the heart-blood and, in a few cases, from the bladder. Direct plating of the gut contents or of scrapings of mucous membranes of the intestine gives, on occasion, almost pure cultures of the organism; in such cases enteritis has usually been a well-marked clinical feature. In other cases, where enteritis is slight or not present, direct plating may reveal only a very few colonies of the organism or none at all, and it may be necessary to resort to the brilliant green technique to obtain a culture from the gut.

Agglutination can be applied in the less acute cases as a *post-mortem* measure for diagnosis.

The following notes on a few of the cases that have been observed may be of some value as indicating the value of the different methods of diagnosis, and, in certain cases, the course of the disease.

Calf No. 3. On the 21/12/25, when about six weeks old, this calf was examined and specimens were taken for diagnosis. According to the owner it had then been sick for a period of 14 days. It had not been inoculated with redwater anaplasmosis vaccine. Mucous membranes injected. Respiration increased in frequency. Examination of blood slides on the 21/12/25 gave a negative result and no anæmic changes were seen. Attempted cultivation of the paratyphoid bacillus from fæces collected on the same date was unsuccessful. Blood collected on the 21/12/25 agglutinated the bacillus in a maximum titre of 1 : 2000. This calf died on 16/1/26, and examination of blood smears taken at *post-mortem* was again negative. Portions of liver, mesenteric gland, and gut were forwarded to the laboratory, and from the liver and gland pure cultures of paratyphoid bacilli were obtained. The plates from the gut also showed numerous paratyphoid colonies.

Calf No. 414. About two months' old when first noticed sick on 21/12/25. Was constipated. Temperature 107°. Mucous membranes injected. Examination of blood smears 21/12/25 negative. Blood taken from jugular vein 21/12/25 gave a pure culture of paratyphoid bacilli. Paratyphoid bacilli were also isolated from fæces collected on this date. The calf was despatched to the laboratory and arrived on 2/1/26. Cultivation from the fæces was again positive on 4/1/26. Daily examinations of blood smears from the 2/1/26 to 7/1/26 inclusive gave negative results. Blood smears 8/1/26 and 9/1/26, *Anaplasma marginale* very rare; 11/1/26, *Anaplasma marginale* not frequent; 12/1/26, *Anaplasma marginale* fairly frequent; *Spironoma theileri* fairly frequent; anisocytosis. The calf developed symptoms of pneumonia whilst at the laboratory and died on 13/1/26. Examination of blood smears at death showed *Anaplasma marginale* fairly frequent, *Spironoma theileri* fairly frequent and anisocytosis; polychromatic cells rare. *Post-mortem* examination revealed lesions in anterior lobes of lung, tumor splenis, enlarged liver, mesenteric glands swollen and congested. Paratyphoid bacilli were obtained in pure culture from the spleen, liver, lung, heart-blood, and mesenteric gland. There were colonies on the plates from the gut. Duration of disease 23 days, intercurrent *anaplasma* infection on the 18th day. This infection may have contributed to the fatal termination.

Calf 346. Arrived at the laboratory alive on the 23/11/25. Visible mucous membranes normal, diarrhœa, died during the night 24-25/11/25. Examination of blood smears 23 and 24/11/25, negative. *Post-mortem* changes: Enteritis, liver swollen, border rounded, mahogany coloured, bile partly inspissated, anterior lobes of lungs consolidated. Tumor splenis, mesenteric glands swollen; numerous petechiæ in cortex of kidney and on pleura. Examination of blood smears negative. Paratyphoid bacilli were obtained in pure culture from the spleen, liver, kidney, heart-blood and mesenteric gland. Numerous paratyphoid colonies on the plates from the gut.

Calf 374. Arrived at the laboratory on the 15/12/25. Condition poor, anæmia, diarrhœa. Examination of blood smears 15/12/25. *Anaplasma centrale* fairly frequent; anisocytosis; polychromasia; basophilia. On the 16/12/25, *Anaplasma centrale* not frequent; anisocytosis only. 16-17/12/25, *Anaplasma centrale* rare; 17/12/25, *Anaplasma centrale* very rare; anæmic changes very slight; 21/12/25, *Anaplasma centrale* fairly frequent, *B. mutans* fairly frequent, anisocytosis; 2/1/26, *Anaplasma centrale* very rare, no anæmic changes, *B. mutans* frequent. 4/1/26, *B. mutans* frequent, *Anaplasma centrale* rare, *B. bigemina* very rare. Occasional basophilic cells; 5/1/26, *B. mutans* frequent, *Anaplasma centrale* rare, basophilic and polychromatic cells rare; 6/1/26, *B.*

mutans frequent, anæmic changes less marked; 7/1/26, *B. mutans* not frequent, anæmic changes slight; 8/1/26, *B. mutans* frequent, *Anaplasma centrale* rare, no anæmic changes; 9/1/26, *B. mutans* fairly frequent, *Anaplasma centrale* rare, anisocytosis; 11-12/1/26, *B. mutans* fairly frequent, *Anaplasma centrale* rare, anisocytosis; 13/1/26, *B. mutans* not frequent, *Anaplasma centrale* rare, *B. bigemina* very rare, no anæmic changes; 14/1/26, *B. mutans* not frequent, *Anaplasma centrale* very rare; 15/1/26, *B. mutans* rare; *Anaplasma centrale* very rare; 16/1/26, *B. mutans* rare. Attempted isolation of the organism from the circulating blood on 16/2/26 negative. Blood collected on the 16/1/26 agglutinated the paratyphoid bacillus in maximum titre, 1 in 2,000. This calf died on 17/1/26. *Post-mortem* examination showed muco-enteritis, tumor splenis (not marked) small area of pleurisy, 5in. by 4in., with adhesion of right lung, mesenteric glands swollen. Examination of smears *post-mortem* showed *B. mutans* very rare. No anæmic changes. Paratyphoid bacilli were obtained in pure culture from liver, spleen and mesenteric gland. Numerous paratyphoid colonies on the plates from the gut. Duration of disease 33 days at least, intercurrent infections with *A. centrale*, *S. theileri*, *B. bigemina*, and *B. mutans*, all of which, except *B. mutans*, had cleared up before death.

Calf SB393. Aged three months on the 15/1/26, inoculated with redwater-anaplasmosis vaccine when one week old. Diarrhœa. Temperature, 15/1/26, 106·2° F. Examination of blood smears, 15/1/26, negative. Paratyphoid bacilli were isolated from fæces collected on the 16/1/26. Blood taken from jugular vein gave no agglutination. This calf was slaughtered on the 17/1/26 and specimens were forwarded to the laboratory. Examination of smears *post-mortem* was negative. Paratyphoid bacilli were obtained from the liver and mesenteric glands in pure culture.

Calf No. 10. Aged three months, sick on the 19/12/25, mucous membranes injected. Examination of blood smears taken on this date gave a negative result. Paratyphoid bacilli were obtained in pure culture from blood taken from the jugular vein. Attempted cultivation of the organism from the fæces was negative.

Calf No. 11. Aged six weeks, had been noticed sick on the morning of 21/12/25; mucous membranes injected. Examination of blood smears taken on the evening of 21/12/25 was negative. Pure culture of paratyphoid bacilli obtained from circulating blood on this date. Attempted cultivation from the fæces was negative.

Reproduction of the Disease by Feeding Paratyphoid Bacilli.

It is possible to reproduce the disease in young susceptible calves by the feeding of comparatively small amounts of pure cultures of the organism. It is, however, only in a small proportion of cases that the disease so induced terminates fatally. The majority of calves recover after exhibiting a more or less severe reaction, to the feeding. The feeding is followed in nearly every case by a well-marked rise of temperature. This rise may commence within two days of the administration of culture or may be delayed for a period as long as fourteen days. At the peak of the temperature curve it is usually possible to recover the bacillus in pure culture from the circulating blood, even of calves that may eventually recover.

Diarrhœa, with the passage of blood and large quantities of mucous is a considerably more prominent feature in the artificially induced disease. Lung lesions have been produced in certain cases by the feeding of cultures. In all cases the culture has been given by stomach tube to avoid any possibility of inhalation. The records of three calves fed with three separate strains of bacilli, are appended to illustrate the course of the artificially produced disease.

Calf X734. Born at the laboratory farm 23/4/26. This calf was fed normally, that is to say, it received the whole of its mother's milk. On 24/4/26, when one day old, it received by stomach tube, 25 c.cs. of a 24-hours' old broth culture of calf paratyphoid bacilli strain X346. The calf was not in very good condition at the outset of the experiment, but continued to improve daily up to the sixth day. On the sixth day, the temperature rose to 104 in the evening, and rigors were noticed together with diarrhœa. The calf died on the evening of the 7th day. *Post-mortem* examination showed muco-enteritis, congested liver, bile yellowish in colour, lungs hyperæmic, blood-stained froth in the bronchi, congestion of kidneys, mesenteric glands slightly swollen and œdematous. Blood smears—no parasites seen, no anæmic changes present. Cultures—paratyphoid bacilli obtained in pure culture from heart blood, lungs, liver, kidneys, and mesenteric gland. Numerous paratyphoid colonies on plates made from the gut.

Calf X1039. Born at the laboratory farm 12/9/26. Received the whole of mother's milk. On 16/9/26, when four days' old, this calf received by stomach tube 20 c.cs. of a 24-hour old broth culture of calf paratyphoid bacilli strain 9444. A typical thermal reaction developed during the 2nd and 3rd weeks. On the 12th day after feeding, the morning temperature rose to 106·2, and the paratyphoid bacilli were recovered in pure culture from circulating blood taken from the jugular vein. The temperature remained fairly high with occasional morning remissions during the following four weeks. Diarrhœa of the "white scour" type was noticeable during the 4th week. During the 5th week, the white scour gave way to a dark-coloured fœtid diarrhœa, accompanied by the discharge of a considerable quantity of mucus. At this time, there was a profuse discharge from the eyes. The calf became progressively weaker, and at the commencement of the 6th week the rate of respiration was increased; shortly afterwards areas of dulness could be detected in the anterior lobes of both lungs. Calf X1039 died on the 49th day after administration of the culture. *Post-mortem* examination showed emaciation; evidence of diarrhœa; enteritis; inflammation of the gall bladder; bile thick, opaque, and golden in colour. The apical lobes of both lungs were consolidated with a profuse greyish exudate in the bronchioles. Blood smears—no parasites seen; no anæmic changes; cultures—paratyphoid bacilli were obtained in pure culture from the liver, lung and mesenteric gland

Calf X1170. Privately owned, hand-reared calf, 38 days' old. Sent to the laboratory as a suspected case of paratyphoid infection on 18/9/26. Diagnosis, probably *Bacillus coli* infection. Some anæmic changes and enteritis present.

Numerous hand-reared calves on this farm had died from the combined effects of pneumonia and enteritis, and no organisms, other than *B. coli*, could be isolated from the organs. Several attempts were made to obtain cultures from the circulating blood of Calf X1170, during the first 10 days after its arrival at the laboratory, but always with negative result; repeated culturing of the fæces gave only *B. coli*. The blood of this calf did not agglutinate the paratyphoid bacillus, and blood smears showed no parasites, and no anæmic changes. During the next four weeks the calf appeared to make a good recovery; coughing at feeding time decreased, and finally disappeared; the action of the bowels became regular, and the fæces normal in colour and consistency. The calf fed well, and its condition became good; the only indication of persisting infection was that the temperature remained somewhat higher than normal.

On 18/10/26, when 69 days' old, Calf X1170 was given by stomach tube, 20 c.cs. of a 24-hour old broth culture of calf paratyphoid bacilli, strain 419. The temperature of the calf rose to 105 on the morning of the 5th day, and 105·6 on the evening of the same day, and on this day, a pure culture of paratyphoid bacilli was recovered from circulating blood taken from the jugular vein. Diarrhœa was a marked symptom from the 7th to 9th days. The temperature fell suddenly on the 12th day after feeding, and the calf died. *Post-mortem* examination: Condition fair, evidence of diarrhœa, acute enteritis, marked hyper-

æmia of both lungs ; blood smears—no parasites seen, and no anæmic changes present. Cultures—paratyphoid bacilli in pure culture from the heart blood, and paratyphoid bacilli and *B. coli* from the organs.

The record of this calf is of interest since it shows that recovery from an attack of ordinary white scour confers no immunity whatever against paratyphoid infection.

Subcutaneous inoculation of cultures is a much less certain method of reproducing the infection. The majority of calves react slightly or not at all with this method of administration.

Infection by Contact with Artificially-induced Cases.

Infection by contact with artificially-produced cases of the disease is by no means common, but does occasionally occur. The record of Calf X732 illustrates such a case.

Calf X732. Was born at the laboratory farm on 16/4/26. It was not in good condition when brought to the laboratory on 19/4/26. The placental membranes were retained for some days by the mother, and her blood was positive to the agglutination test for contagious abortion, although the calf was a full term one. This calf was inoculated on 19/4/26, with 5 c.cs. of blood, containing *B. bigemina* and *Anaplasma marginale* (the so-called wild strain of redwater and gallsickness vaccine), and was placed in contact with six calves to which paratyphoid bacilli had been fed on 17/4/26. Nothing abnormal was noticed during the first two weeks of exposure, with the exception of occasional rises in evening temperature, and blood smears taken during the second week failed to show any evidence of infection with *B. bigemina*. On the 14th and 15th days, the calf showed diarrhœa coincident with a sharp rise in temperature to 104·8. During this reaction, the calf lost condition, but continued to feed a little. The fæces which were light yellow when the scouring first commenced became dark brown in colour on the 17th day ; the diarrhœa continued until death. On the two days prior to death the calf showed a lack of co-ordination of the movements of the hind limbs. Blood smears taken daily during this period, showed no parasites and no anæmic changes, other than slight anisocytosis and on the 16th day a few polychromatic cells. The calf died during the night of the 18th/19th days. *Post-mortem* examination : Condition poor, evidence of diarrhœa, muco-enteritis, liver congested, bile yellow in colour, lungs slightly hyperæmic, bronchial, mediastinal and mesenteric lymphatic glands slightly enlarged and œdematous. Some congestion of the mucous membranes of the bladder, urine normal in colour. Blood smears—no parasites seen ; slight anisocytosis. Cultures—paratyphoid bacilli obtained in pure culture collected from the heart blood, spleen, liver, and mesenteric glands.

PREDISPOSING CONDITIONS.

It is well recognised that certain conditions greatly favour the development of specific intestinal diseases. In addition to the ordinary factor of unhygienic surroundings the more important of these predisposing conditions appear to be :—

(1) Youth.
(2) Prolonged periods of fasting, particularly in young animals.
(3) The administration of unsuitable food leading to mild non-specific digestive disturbances.
(4) The intercurrence of other debilitating diseases.

(1) *Youth.*

Fatal paratyphoid infection in Kenya appears to be confined mainly to calves between the ages of three weeks and three months old, although a few cases occur between three and four months. The majority of deaths, however, occur during the second month of life.

Only one definite case of paratyphoid infection in an adult ox, due to the same organism as that isolated from calves, has been observed by the writer in Kenya. This was in a three-year old pure-bred Shorthorn bull, which died after showing symptoms typical of paratyphoid infection. Examination of smears gave a negative result, and a bacillus identical with that recovered from calves was obtained in pure culture from the organs and glands, and almost in pure culture from inflamed portions of gut. This case occurred on what is perhaps the most heavily infected farm in the country. One other outbreak of paratyphoid infection in adult cattle has been observed in Kenya. In this instance quite an extensive outbreak occurred among dairy cows, but the organism responsible was an inosite-fermenter of the paratyphoid "*B*" *œtrycke* group.

(2) *and* (3) : *Prolonged Fasting and Unsuitable Feeding.*

It has been shown by Besredka and his collaborators, that fasting of experimental animals prior to the administration of cultures considerably increases the chances of successfully infecting the animals with the causal organisms of specific intestinal diseases. Unpublished observations of Daubney and Galloway with reference to the artificial infection of lambs and rabbits with *B. coli* and of rabbits with *Salmonella* confirm Besredka's findings on this point. Mitchell (1925) has also shown that prolonged periods of fasting have considerable influence upon the incidence of paratyphoid infection of lambs in the United States of America. It is fully appreciated by stockowners generally that unsuitable feeding of young stock will result in a succession of slight digestive derangements which will constitute an extremely favourable opportunity for infection by the causal organism of any specific intestinal disease. Under experimental conditions Besredka and numerous other workers have made use of preliminary doses of ox-bile, or of sodium sulphate to create a flow of bile, to enhance the chances of infection by subsequent administration of culture of a specific organism. By previous administration of small quantities of bile and by fasting for periods of twenty-four hours, Besredka was able to infect rabbits by the mouth with typhoid bacilli, although ordinary feeding of the bacilli without the fasting or the bile failed to infect.

The principle of taking from the cow milk normally intended for the nourishment of the calf, reacts unfavourably upon the chances of survival of the calf unless other factors are introduced to reinstate the normal balance. This balance is usually easy to maintain because dairying cattle have been so improved that they produce milk far in excess of the normal requirements of a calf. It is also possible to use substitutes in the shape of meals and oils for a certain amount of the milk ration, and especially for the butter fat. In Kenya, however, the majority of cattle used for dairying are either low-grade animals of relatively poor milk-producing power or even ungraded native stock. The practice here is to milk once or twice a day, leaving the strippings or perhaps one quarter of the udder for the calf if milking twice is practised ; or, if milking once, separating the calves from their mothers for roughly twelve hours before the milking period and allowing them to suck during the remaining twelve hours.

In one case the calves are fasted for almost twelve hours between each meal, and in the other case a period of

approximately twelve hours, during which the calf is at liberty to feed, alternates with another period of almost twelve hours fast.

In experimental observations fasting for periods of twelve hours before the administration by the mouth of a culture does not seem to have any appreciable effect since nearly all the animals, whether fasted or not, react to the infection: yet it is possible and even probable that prolonged periods of fasting do increase the chances of natural infection, and greedy feeding on the part of a calf after twelve hours fasting does undoubtedly result in mild digestive disturbances which make the calf a readily susceptible subject for paratyphoid infection. Another disadvantage attaching to this system of milking is that it necessitates the collection of the calves in a comparatively small pen at milking time, since low-grade cattle are commonly, although perhaps erroneously, reputed not to give milk unless the calf is present; and frequently also the penning of the calves during the night in an insanitary boma where there is every chance of spreading infection once an outbreak is started. In Kenya, paratyphoid infection does not seem to be a disease of hand-reared calves, although it must be conceded that there are few farms on which hand-rearing is practised, and, therefore, observations are limited. Farmers who practise the hand-rearing of calves suffer quite considerably from intestinal diseases among the calves, but in those cases that have been investigated, paratyphoid infection has not yet been diagnosed. The commonest infection in hand-reared calves in this country appears to be *Bacillus coli* septicæmia resulting in pneumonia and enteritis, terminating in many cases fatally. The record of calf 1170 is interesting in this respect. This calf was despatched to the Laboratory when suffering from pneumonia and enteritis due apparently to *Bacillus coli*. Numerous cases of this disease have been investigated on this particular farm and in no instance were any non-lactose fermenting organisms isolated. At the time of its arrival at the laboratory, calf 1170 was forty-eight days' old; it was hand-fed and made an uninterrupted recovery. Four and a half weeks later it was fed with a small dose of paratyphoid culture, reacted typically, giving a positive blood culture on the fifth day after feeding, and died on the twelfth day after feeding. Prior to this feeding the fæces and blood of this calf had repeatedly failed to give cultures of paratyphoid and the blood gave no agglutination reaction.

Climatic Conditions.

It is possible that climatic conditions may exercise an influence on the incidence of paratyphoid infection. Some of the worst infected farms in Kenya are at altitudes considerably over 9,000 feet, and in districts where there is excessive rainfall and lack of sun.

The following record compares the monthly death-rate amongst sucking calves with the monthly rainfall on a heavily infected farm, during the year 1925 and part of 1926. This farm is at an altitude of 11,000 feet, and is probably the most heavily infected farm in the country. There appears to be a fairly close correlation between the heaviness of the rainfall and the number of deaths occurring. The rainfall is at its heaviest in May, June, July and August, and this is equally the most fatal period for calves. The sudden increase in rainfall to 8·48 in November appears to be reflected in the deaths taking place in the next month. During January, February and March, 1926, a large proportion of the calves on the farm were vaccinated with a killed vaccine, but it is extremely doubtful, in view of our later experience on this farm, whether any credit should be given to the vaccine for the fall in the death-rate during these months. It is much more likely that the decrease is due to the more favourable weather conditions.

1925. Month.	Total No. of Unweaned Calves on Farm.	Total Deaths.	Total Rainfall Inches.
January ...	314 ...	18 ...	4·90
February ...	390 ...	10 ...	0·54
March ...	400 ...	22 ...	4·23
April ...	455 ...	17 ...	0·62
May ...	437 ...	28 ...	8·25
June ...	443 ...	56 ...	7·44
July ...	469 ...	57 ...	8·63
August ...	449 ...	60 ...	10·03
September ...	462 ...	28 ...	1·32
October ...	434 ...	38 ...	1·63
November ...	378 ...	28 ...	8·48
December ...	382 ...	40 ...	3·03
1926.			
January ...	375 ...	22 ...	0·96
February ...	372 ...	16 ...	2·29
March ...	387 ...	21 ...	1·31

(4) *The Co-existence of Tick-borne Diseases.*

One factor which must be given consideration in assessing the influence of pre-disposing conditions is the almost universal infection of calves with certain tick-borne diseases. In Kenya the great majority of calves acquire infection with *B. bigemina*, *Anaplasma marginale*, *Spironema theileri* and *Babesia mutans* at a very early date, probably as a result of bites of ticks during the first few days of life. Under normal conditions the reaction of calves to these infections is usually so slight as to escape observation. This is certainly true of calves other than pure-bred animals or calves bred from imported stock. In the case of the latter the reaction to *Anaplasma marginale*, which occurs generally during the third month of life, may be sufficiently great to necessitate a certain amount of treatment and nursing. The reaction to *Babesia bigemina* is hardly noticeable in any young calves under normal conditions, nor is that to *Babesia mutans*. *Spironema theileri* produces a slight thermal reaction, as a rule quite unaccompanied by symptoms. A certain number of cases of paratyphoid infection have been observed in which the infection has been complicated in the later stages by a reaction to natural infection with *Anaplasma marginale*. In the case of calf X414 (see above), the reaction to *Anaplasma marginale* commenced nineteen days after the calf had first been noticed sick and the calf died five days after the commencement of the *Anaplasma marginale* reaction.

The record of calf 374 is also of interest in this connection. Calf 374 arrived at the laboratory on the 15/12/25. The blood of this calf agglutinated the paratyphoid organism in a dilution 1:2000 on the 16/12/25, indicating that the calf had then been sick for some little while. At the time of admission to the laboratory, this calf showed a fairly heavy infection with

Anaplasma centrale, probably derived from the vaccination with the laboratory Anaplasmosis vaccine. During the following three weeks the Anaplasmosis reaction receded and the anæmic changes disappeared. During the third week a mild thermal reaction was noticed and the blood became heavily infected with *Babesia mutans*. During the reaction to *B. mutans* anæmic changes again became evident, and on two occasions a few *B. bigemina* were seen in blood smears. The reaction to *B. mutans* receded during the fifth week and from the commencement of the sixth week to the time of death there were no anæmic changes and small piroplasms were very rare in blood smears. In this instance the successive infections with *Anaplasma centrale* and *B. mutans*, accompanied by a slight recurrence of *B. bigemina* infection did not appear to affect in any way the ultimate course of the disease.

It has been our practice when investigating paratyphoid infection to request owners to furnish blood smears of sick calves at the time of the onset of illness and again at death, and it has not been uncommon to find animals giving a positive diagnosis to paratyphoid and showing at the same time an infection with *Anaplasma marginale*, frequently accompanied by apparently severe anæmic changes. The presence of anisocytosis, basophilia and numerous polychromatic cells at the time of death, together with an *Anaplasma* infection, has been regarded as strong evidence in favour of the view that *Anaplasma marginale* was the cause of death. It is possible, however, that in an examination of blood smears from young calves too much importance can be attached to the appearance of anæmic changes that might be reasonably regarded as severe in an adult animal It is reasonable to consider certain changes mentioned as evidences of a too rapid regeneration of blood cells, stimulated by the destruction of red cells in the circulation. It is also well known that calves during the first fortnight of life may show all these changes in blood smears merely as a result of the normal functioning of their nemapoietic system. It might reasonably be supposed, therefore, that slight stimulation only is required to bring about such anæmic changes as appear in calves affected with Anaplasmosis. It is also certain that the anæmic changes in these cases can and do disappear within the course of twenty-four hours. An attempt was made at the laboratory to assess the effects of redwater and anaplasmosis infection when combined with paratyphoid infection.

Six calves, varying in age from 23 days to 126 days, were inoculated ; three with *Anaplasma marginale* and redwater and three with *Anaplasma centrale* and redwater. The calves were fed with a small quantity of culture of paratyphoid bacilli. All the calves gave a thermal reaction to the paratyphoid feeding. One calf, inoculated with *Anaplasma centrale*, reacted markedly to the inoculation ; but although four others showed *anaplasma* as a result of inoculation none gave a marked reaction to the inoculation. All the calves recovered. These calves were fed in the usual manner.

Six other calves varying in age from 44 days to 103 days were inoculated—three with *Anaplasma centrale* and redwater and three with *Anaplasma marginale* and redwater. All were fed with a small quantity of culture of paratyphoid. The mothers were milked as though for cream production and the calves received only the strippings. All the calves reacted to the paratyphoid feeding. One gave a thermal reaction also to *Anaplasma centrale*. One calf aged sixty days gave a slight reaction to the inoculation of *B. bigemina* and one calf, No. 524 died twelve days after the commencement of the reaction to *Anaplasma marginale*, and five days after a second feeding of Paratyphoid culture given at the height of the reaction to *Anaplasma marginale*. At the time of death *Anaplasma marginale* were present in 0·85 per cent. of red cells, *B. bigemina* in 0·08 per cent. of the cells and *B. mutans* in 0·04 per cent. of the cells. There were no anæmic changes.

It is possible that the two infections are jointly responsible for the death of calf 524, although the characteristic temperature curve with marked morning remissions following the rise during the second week suggests that the chief factor concerned is paratyphoid infection. It is also significant that at the time of death infection with protozoan organisms was extremely light and there were no anæmic changes present.

Altogether during the course of these experiments, which it is unnecessary to record in detail, twenty-four calves were inoculated with redwater and anaplasmosis, twelve with *Anaplasma centrale* and thirteen with *Anaplasma marginale*. Of these calves three died, No. 524, to which reference has already been made, and Nos. 815 and 416. No. 815 was inoculated with *Anaplasma marginale* alone and was placed in contact with paratyphoid-fed calves. This calf died nine weeks after inoculation, having shown no marked reaction either to redwater or anaplasmosis. The cause of death was apparently peritonitis and did not seem in any way to be connected with the inoculation. Examination of blood smears at death gave a negative result. The third calf, No. 416, died thirty-three days after inoculation with *Anaplasma marginale*. On the 31st day the temperature rose from 100·4 in the morning to 105·4 in the evening. *Anaplasma marginale* were fairly frequent in the blood smears. The temperature dropped on the following morning to 100·8 and rose in the evening to 102. The temperature then became sub-normal and the animal died. *Post-mortem*, the liver appeared normal although there was slight jaundice of the tissues. The lungs were œdematous and contained small hæmorrhages. The urine was blood-red in colour. Examination of smears showed that *Anaplasma marginale* was present, but not very frequent, *B. bigemina* very rare, anisocytosis, basophilia and polychromasia. Calf 416 died apparently as the result of a recurrence of redwater during the *Anaplasma marginale* reaction. Calf 416 at the time of inoculation was eighty-three days old.

To summarise, of twenty-five animals inoculated with anaplasmosis and of which some also were fed with paratyphoid, two animals died showing infection with *anaplasma*. One of these animals was also infected with paratyphoid, but the remaining animal died, apparently from a recurrence of redwater. Of a total of twelve of the same animals to which paratyphoid cultures were fed, one died of paratyphoid during the anaplasmosis reaction. The average age of the calves to which paratyphoid bacilli were fed was seventy-six days, which means that these calves had passed the most susceptible period to paratyphoid infection.

These observations do not assist one to form conclusions as to the relative importance of paratyphoid infection and anaplasmosis as a cause of mortality. A series of observations carried out on smears and specimens does, however, furnish more satisfactory evidence. It has been arranged with the proprietors of an infected farm to furnish specimens of gut, gland, and liver from all the calves dying in one of the herds during a certain period.

The details of specimens and smears received are charted in figures. The curve showing the total number of specimens examined during each month of life may be taken as fairly accurately representative of the number of deaths occuring during the period under review. The blood smears shown were, however, taken at the commencement of the illness, and at death, if the illness terminated fatally, although two such smears from one animal are counted for the purposes of this record as one. In addition, certain of the animals from which smears were taken recovered and therefore the numbers of smears examined may be taken as an index of sickness only and not of deaths. It will be seen that the peak of the deaths occurs during the second month of life and, indeed, the owner of this farm had already stated that 70 per cent. of the total of deaths occur between the ages of one and two months. The number of deaths declines very rapidly during the third month of life, although judging by the smears received the number of cases of sickness are not noticeably decreased during this month. There are certain salient facts that emerge from an examination of these charts. It is evident that the greatest number of cases of paratyphoid occurred during the month in which the greatest number of deaths occurred, and that during that month approximately 80 per cent. of the specimens from dead animals gave a positive diagnosis of paratyphoid. During the same period only 44 per cent. of the specimens examined showed anaplosmosis. The *anaplasma* infection reached its maximum during the third month, when approximately 66 per cent. of the smears examined were positive for *anaplasma* infection. During this month, however, the death rate appears to have declined by approximately 60 per cent. Another fact of importance not shown on these charts is that, of the specimens included, there were thirteen positive cases of paratyphoid occurring between the twenty-first and thirty-eighth day of life, while the first positive anaplasmosis smears are not recorded until the forty-second day. The information gathered by this record shows also that a certain number of deaths occur during the first four weeks of life, chiefly as the result of intestinal disturbances due variously to infections with *Bacillus coli*, *B. proteus* and *B. pyocyaneous*, that the paratyphoid infections do not commence until about the twenty-first day of life, and reach their peak during the second month. *Anaplasma* infection, on the other hand, does not commence until the forty-second day and reaches its peak of infection during the third month, when the deaths are rapidly declining. One might conclude that while an intercurrent *anaplasma* infection may assist in producing a fatal termination to a paratyphoid infection, yet the majority of losses from paratyphoid are incurred independently of *anaplasma* infection.

Viljoen and Martinaglia state that in South Africa the mortality is confined to farms where no effective measures for the eradication of ticks have been taken, and that although paratyphoid infection may occur in the absence of this important factor, in practice it seems to be a complication of protozoan diseases. They suggest that the disease can be controlled very largely by practising sound farming measures such as regular dipping of all cattle, proper feeding and management of calves. In Kenya, it would appear that in this connection less importance can be attached to infection by tick-borne diseases than is the case in South Africa. It might also be remarked that the organism obtained from outbreaks in Kenya shows certain differences from the ordinary Gærtner strains, such as those isolated in South Africa and in Europe generally.

Other points of interest in connection with the relationship of paratyphoid infection to protozoan diseases are :

(1) The entire absence of losses from anaplasmosis on farms uninfected with paratyphoid.

(2) The prevalence of paratyphoid infection in the dairying districts of Germany, Switzerland, and Denmark, where hæmatozoan infections are comparatively unimportant.

(3) The well-recognised tolerance of young animals to infection with blood protozoa of the *piroplasma* group.

In introducing the paper, Mr. Daubney demonstrated numerous charts, specimens, and cultures, illustrating the effect of experimental feeding of the organism, treatment with anti-serum, and the bacteriological reactions of the organism.

Bacteriology.

Some seventy strains of the organism have been isolated, and examined, and all the strains have proved remarkable considered in their bacteriological characters. There are very definite distinctions to be demonstrated between the organism in question, and ordinary stock strains of "*Salmonella enteritidis* (Gærtner)." The ordinary sugar fermentation reactions agree with those of *S. enteritidis*, except in the case of the pentose, xylose—that is to say, the bacillus from calves ferments the following carbohydrates, with the production of acid and gas :—Dextrose-lævulose, galactose, arabinose, rhamnose, maltose, mannite, dulcite, mannose and sorbite. It does not produce either acid or gas in the following :—lactose, saccharose, dextrin, inulin, salicin, raffinose, inosite, adonite, erythrite, or xylose. Litmus milk is at first slightly acid, and from the sixth to the eighth day becomes strongly alkaline ; lead acetate medium is blackened. The inability to ferment xylose is shared by all the strains isolated from animals on infected farms, and strains have been tested after twelve months cultivation in the laboratory, with exactly similar results. A further difference is apparent when the organism is cultivated in Hetsch's medium, consisting of litmus-nutrose-mannite solution. Of eighteen stock strains of *S. enteritidis* derived from the National Collection of Type Cultures, fifteen coagulated this medium within forty-eight hours ; of the remaining three, one, No. 2139, produced a clot in five days, and two did not clot in ten and sixteen days respectively. It is interesting to note that one of the latter strains is Lister Institute No. 577, from a calf. Of all the strains of bacilli isolated from infected calves, only one produced a clot in this medium

in forty-eight hours. Two strains Nos. 70 and 13 produced a clot in seven days. The remaining strains failed to coagulate the medium in forty days and, in the majority of cases, failed to produce opacity in this period.

When xylose was substituted for the mannite in Hetsch's solution, none of the strains from the calves—except one which coagulated the xylose solution in forty days—was able to coagulate the medium, while all the type *Gærtner* strains, except one, produced a coagulum within forty-eight hours.

In cross-agglutination tests, carried out with serum produced by the inoculation of rabbits with strains from calves, stock strains of *S. enteritidis* agglutinate to the maximum titre. The strains of the Para A and B group agglutinate only in the lower dilutions, and Para C not at all.

The organism has only been isolated from animals on farms known definitely to be infected with the disease. Numerous attempts have been made to isolate the organism from the alimentary tract and organs of animals dying from other diseases, on uninfected premises, and in no case has a non-xylose fermenting strain of *S. enteritidis* been obtained.

Fairly extensive investigations have also been carried out on farms where there is a considerable death rate among calves, chiefly under one month old, from intestinal disorders, accompanied by infection of the organs with *B. coli*, *B. pyocyaneous*, organisms of the *proteus* group and delayed lactose-fermenting organisms of the Sonne dysentery type. Contrary to expectations, it was found that the occurrence of *S. enteritidis*, either in the gut or organs during such infections, was extremely rare; indeed, only in one case was an organism of the Gærtner type isolated; this strain, No. 11007, proved to be an ordinary Gærtner, producing acid and gas in xylose, and coagulating Hetsch's solution in forty-eight hours. It may be stated, therefore, that the occurrence of the non-xylose fermenting type has always been associated with a definite infection of calves, from one to four months old, and that this infection remains enzootic upon certain farms, and is invariably associated with a definite history of heavy losses among calves at these ages.

Prevention.

With regard to preventive treatment, killed vaccine has been issued to farmers, but while it has appeared to meet with a very high degree of success on some of the smaller farms, the results have been disappointing in the case of the more heavily infected herds. At the present time, a live attenuated culture is being tried. A hyper-immune serum is also being issued, and is used where necessary to control the reactions from the living vaccine; the serum is also being used with some success in the curative treatment of animals already infected. Charts were demonstrated to show that a dose of hyper-immune serum given simultaneously with a dose of virulent culture, by the mouth, resulted in complete, or almost complete "block-out" of the usual febrile reaction, and even when there was a transient rise in temperature a few days after the feeding, it had always proved impossible to recover cultures of the organisms from the circulating blood of animals that had also received serum. Control

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FORTY-FIFTH ANNUAL MEETING OF THE N.V.M.A.

At the time of going to press there is only time to report that a very good beginning has been made at this year's Annual Congress. The setting of so beautiful a place as Torquay cannot fail to make the Congress a success, and, judged from the point of view of attendance at the opening meeting, a high mark has been established. This is just as it should be, and it only remains for the Clerk of the Weather to be gracious in conduct and less lachrymose, to make the occasion a really pleasureable one.

The Provisional Committee is to be congratulated on the excellence of the programme of social events made for the enjoyment of members, and one and all wish that their efforts and plans will not be frustrated by the unkindliness of weather we have experienced for some time past. As an Association and, indeed, as a profession, we very much appreciaate the kind address of welcome by His Worship the Mayor of Torquay, and the more than kind thoughts and wishes expressed by him on behalf of the Corporation and all the citizens of Torquay for the enjoyment of our visit to the town, and the very useful purpose for which we stand. It is needless to add that a very hearty vote of thanks was accorded to him in a few choice words from the President.

The Annual General Meeting is always made the occasion of a Presidential Address, an account of his stewardship, as it were, during his reign of office, and a review of progress and the Association's usefulness during the past year. It is satisfactory to note, and it certainly constitutes a hall-mark of progress and prosperity, that one hundred and forty new members joined during the year. This is all the more remarkable in view of the fact that the increase of the previous year only amounted to fourteen. We express the hope that membership will continue to increase, for thereby our power and recognition of our usefulness as an organised force increases. An important item of our organisation lies in the inclusion of colonial members and the approval of affiliation of colonial veterinary organisations. Up to date the Veterinary Associations of British Columbia, Southern Rhodesia, Uganda, and New Zealand

have joined, and Australian and other associations in course of time will probably do likewise. When brotherhood of this nature is established, the mutual assistance which can be given is all to the good of Empire and professional interest. For instance, there are questions at the present moment of pay and conditions of service in some of our young colonies which require adjustment, and which the National Veterinary Medical Association can materially help in putting on a better basis. It unquestionably comes within its function and duty to its members, whether individually or collectively, under organised affiliation.

The Annual General Meeting, too, is the occasion when the election of the new President is made. For the ensuing year choice has fallen on one who has served the Association most loyally for many years, and who is honoured in the profession for his high qualities and sterling worth. The welfare of the Association will be very safe in the capable hands of Mr. J. W. McIntosh, and the unanimous approval given by members attending the Congress is a fitting indication of the support he will receive during his year of office, and of the success which all hope for. The duties of President are by no means light; indeed, we may term them distinctly onerous. For instance, the past President attended no less than seventy meetings during his term of office. One cannot but be deeply grateful to him for such considerate activity, given gratuitously for the benefit and advancement of his profession, but one cannot also but feel that such a high standard is a difficult one to which to live up, and wonder if, when financial circumstances admit, that in some way costs on account of travelling for the President may be considered.

Another point considered at both the Council and General Meetings was a proposal for an appropriate system whereby veterinary treatment of poor people's animals could be effected, so much of present procedure being in the hands of unqualified persons. The story is a long one, but opinion would appear to turn on an understanding made with a responsible and reputable society such as the Royal Society for the Prevention of Cruelty to Animals, where scientific treatment would be a practical expression of monies devoted benevolently for the welfare of animals and the alleviation of their sufferings.

(Continued from previous page.)

animals to which cultures of the same strain were given exhibited in each case a characteristic febrile reaction, and the organism was recovered from the circulating blood at or near the peak of the temperature curve. "Blocking-out" of reactions by serum did not appear to have any ill effect upon the chances of acquiring an active immunity as a result of the feeding. This was demonstrated by subsequent test-feedings of virulent cultures some six or eight weeks later.

(To be continued by report of the discussion).

CLINICAL AND CASE REPORTS.

Sudden Blindness associated with Enteritis.

By J. W. Rainey, M.R.C.V.S., London.

Subject.—A valuable nine-years-old light vanner gelding, employed by a firm of ginger beer brewers in daily delivery to shops in London.

History.—Never known to be ill, but a notable scavenger, constantly eating refuse from gutters when waiting outside back-street shops. Had done the usual day's work.

Symptoms.—When called in the following morning, the symptoms observed were those of enteritis—restlessness, pyrexia, abdominal pain, and diarrhœa. Later in the day it was observed that there was paralysis of the nerves of both eyeballs; the pupils were fixedly dilated and blindness was complete. The eyeballs were slightly rotated downwards. There was no appetite for food, but considerable thirst; water, containing appropriate doses of the bicarbonate of soda and common salt, was freely given. The diarrhœa persisted for three days and treatment was continued for six days; at the end of that time recovery was complete excepting the eyeballs which remained paralysed—total blindness.

Diagnosis.—Poisoning from some substance eaten—possibly a lead paint.

Prognosis.—The animal has been turned out to grass under special care, but there seems no reason to think that sight will be restored.

Horse-fat as a Basis for Ointments.

By J. W. Rainey, M.R.C.V.S., London.

A few years ago the writer communicated some preliminary observations upon the use of purified horse-fat as a basis for ointments used in equine practice.

Since then extensive trial has shown that an ointment prepared from the B.P. formula for boric acid ointment is too soft on a basis of horse-fat, whereas an ointment on the lines of the B.P. unguentum zinci is too crumbly.

In discussing these difficulties with a firm of manufacturing chemists, it was suggested that a mixture of the two formulæ with wax on a horse-fat basis might prove satisfactory.

The suggestion was a happy one: an ointment so prepared has now been used in the writer's practice for more than two years and it is free from any objection of a pharmaceutical nature. The superiority of this ointment over those made with vaseline or lard lies in the fact that it is not irritating to the horse's skin; it may be used with advantage in contusions and lacerations of such sensitive areas as the orbit, the heels, the backs of the knees, as well as for hastening the maturation of abscesses and the separation of sitfasts on neglected backs.

Perhaps there is evidence of the utility of the horse-fat ointment in its increasing popularity with the horse-keepers and the owner-drivers among the writer's clientèle; locally known as "Some of that white salve," it is now in constant demand.

On account of the possibly objectionable nature of the *unpurified* raw material, the writer does not attempt to prepare the ointment himself; it is supplied to him ready-made by the firm of chemists, who originally suggested blending the two formulæ, at a cost of 2s. 6d. per pound.

Death from Absorption of Nicotine.

By E. MORGAN, M.R.C.V.S., Faversham.

Subject.—Bay harness mare, 15 years, suffering from itchy legs.

I arrived as the animal was breathing its last gasp; the owner told me she died in great agony. Half an hour before he had well rubbed pure nicotine into the legs. The mucous membranes were a bright violet colour.

Rectal Prolapse in a Bulldog.

By HAMILTON KIRK, M.R.C.V.S., London.

In January of this year I was asked to examine a Bulldog puppy, about four months old, with a view to its purchase for £25. It passed me with a clean bill of health, and the dog was bought.

Exactly seven days afterwards it developed the early signs of distemper, for which I treated it in my hospital. The attack was mild and the pup commenced to convalesce at the end of a fortnight.

One morning the rectum was found protruding for about three inches. Reduction was effected and the pup given 3 grs. chloretone. On the following day, January 27th, the bowel was down again and was replaced. Three quarters of a grain of morphia was given and two sutures placed across the anal orifice. In addition, the puppy was put on a light diet, with a teaspoonful of medicinal paraffin twice daily.

The next day narcosis had worn off and straining was persistent. There was a smell of decomposed blood, which was so powerful and objectionable that I added 30 m. Dimol syrup to the paraffin. In spite of sedatives given, and the relaxed action of the bowels, straining was persistent and I began to think the sutures were the cause, and removed them. The bowel was afterwards douched with a cold solution of liq. plumbi subacet, which procedure was regularly continued for three days.

Everything went well until the 31st., when there was a larger prolapse than ever. It evidently had been out some hours, too, judging by the deep discoloration which had taken place. Cold solutions of lead acetate were injected per rectum and ½ gr. morphia introduced subcutaneously. After reduction had been effected on this occasion, a stout suture was inserted across the centre of the anus.

On the 2nd February, straining was continuous and the suture gave way, though no prolapse occurred until the next morning. This time I inserted a purse string suture, the dog being kept on liquid food, Dimol and paraffin, and chloretone. After four days all seemed normal and there was no straining. The suture was removed and the pup allowed to go home.

I suppose the excitement of getting home was responsible for a further prolapse, which occurred three hours after reaching there. Another purse string was inserted; and doubts arose in my mind as to whether there might exist an accompanying intussusception. Nothing could, however, be discerned by palpation of the abdomen.

The dog being valuable and the trouble so persistent, I decided to consult Professor Wooldridge, who suggested that as I had brought the dog to the College, we might make an immediate exploratory laparotomy. This was done, but nothing abnormal found. The pup began to feel the strain of so much operative interference, but it recovered quite rapidly from this more severe measure; and during the healing process two stout sutures were kept across the anus. Fourteen days later healing was complete, straining had ceased, and the dog had grown tired of slop diet. I decided to remove the anal sutures, and for several days all seemed well.

The day finally arrived when the owner was due to go abroad, and preparations were made for taking the patient. Fate, however (and an elongated rectum) decreed otherwise, for on the eve of departure a good three inches of bowel came down again for the seventh time.

This exasperating occurrence called for more energetic treatment and I determined to excise the prolapsed portion. Under general anæsthesia a series of sterilised sutures was introduced from the external surface to the lumen or internal surface. These were inserted about ¾ inch from the anal ring. Instead of passing some metallic or other elongated instrument into the lumen, as a guide to the needle, I introduced my finger, and found it a far easier and more precise method of directing operations. So soon as the point of the needle was appreciated on my finger, I could then direct the needle back again, thus effecting the close approximation of the two free ends of the silk on the outer surface for tying purposes, without the risk of getting the opposite wall of the lumen included in the suture.

About eight sutures of this kind were inserted, after which the prolapsed bowel was excised about half an inch posterior to the sutures. The stump was carefully returned and smoothed out, and on a nourishing liquid diet for four or five further days, recovery was eventually complete.

The dog returned home sixteen days after the amputation, but I was called to see it a month later as it was thought that the animal had colic and could not pass its stools. I suspected a stricture following the operation, but the passage was quite open.

After another week on liquid paraffin and chlorodyne the symptoms passed off and there has not, up to date, been the slightest further trouble.

Venereal Disease in a Stallion.*

By S. J. KNEEBONE, B.V.Sc., Adelaide, South Australia

On September 1st, 1926, the writer was consulted regarding a peculiar condition of the sheath and penis of a Clydesdale stallion. The condition had first been noticed some eight days previously, but, largely owing to the distance from Adelaide (100 miles) and the fact that the

*Reproduced from the March 1927 issue of the *Australian Veterinary Journal.*

stud groom did not consider the condition serious, professional advice had not been obtained before.

Prior to the occurrence of the condition the horse had served a wet mare which seemed to be "not quite clean" as the groom said. In the process the stallion cut the skin of the penis near the root. When the animal returned home it was douched with a solution of Condy's crystals. About seven days later a rash appeared on the surface of the penis in the vicinity of the cut and rapidly extended over the whole surface of the penis and the internal fold of the prepuce. The rash gave way to a vesicular eruption, and this in turn left depressions similar to pox marks on the surface of the organ. The writer saw the animal in the stage when both these latter conditions were present in different parts of the organ. The *fossa glandis* also seemed to be infected, and there was a slightly yellowish and scant exudate at the urethral process. The owner had been treating the penis with Condy's fluid washes twice daily. The writer painted the whole of the exposed penis and prepuce with tincture of iodine, after having first obtained smears from the lesions. A 1 in 4,000 solution of hydrargyrum biniodide was used to flush out the *fossa glandis* and to inject into the urethra. The owner was instructed to repeat this twice daily, and to smear on boric ointment if the epithelium showed signs of cracking. Exposure of the organ was always easily obtained for dressing by production of a mare on heat.

The smears were submitted to Dr. Bull, who stated that they were crowded with organisms—streptococci, staphylococci and a diplococcus predominating. At his suggestion, when the writer again visited the animal two days later (September 3rd) a 1 in 1,000 solution of a mixture of brilliant green and crystal violet was sprayed on the penis and prepuce and injected into the urethra. Injections of mixed infection vaccine were also given. Swabs from the urethra and lesions showed a predominance of diplococci. The owner was given instructions to expose the penis for as long as possible to enable air and sunlight to play their part and obviate, as far as possible, the incubator-like effect of the penis in the prepuce.

When next visited (September 9th) the external lesions were healing nicely, but there was still considerable brownish discharge from the urethra. The writer was then shown two Clydesdale mares which had been served by the stallion just previous to the rash having been noticed. They had been out, but when brought in each showed lesions on the vulva similar to those which the stallion had exhibited on the penis. Each mare had been served only once. A swab was also taken from the mare suspected to have originally caused the trouble, but bacteriological examination did not reveal anything significant.

The stallion was now beginning to pass urethral casts when urinating. Injections of crystal violet and brilliant green were restricted to once a day. The external lesions were practically healed.

On September 13th, when the final visit was made, the external lesions had healed. A swab from the urethra showed no bacteria. The animal was losing extensive casts, some measuring up to twelve inches. These were passed at the end of urination, and it would therefore appear that they were coming from the bladder. The treatment was discontinued and the last dose of vaccine given. During the whole time the temperature was not elevated more than two degrees and the animal kept in condition. The affected mares responded readily to applications of tincture of iodine.

The bacteriology of the disease cannot be said to be solved. The complaint was apparently extremely infectious and probably was contracted at the time the mucous membrane of the penis was broken when serving the wet mare, as lesions commenced with this point as a focus.

Dr. Bull and the writer both saw the horse at the Royal Show in Adelaide (October 6th), when it appeared normal except that the urine was somewhat brownish at the end of micturition, suggesting that there was a slight cystitis.

As far as we are aware no cases quite similar have been recorded, although Professor Wooldridge describes a similar condition (exanthema) which possesses some points in common with that just described. In his cases the scrotum, penis, sheath and the inside of the thighs and the abdomen may be affected with a vesicular and pustular eruption. The free end of the urethra may be involved, and there may be a muco-purulent discharge therefrom. In the mare the condition is confined to the vulva and vagina, and there is a profuse purulent discharge. In the case under review the discharge was very scant and the pox-like depressions seem to be distinctive, the whole process suggesting a specific infection possibly by a filterable virus.

Trephining and Repulsion of Teeth.*

By Captain Joseph H. Dornblaser, U.S. Army Veterinary Corps.

The purpose of this article is to attempt to cite a few of the advantages of the trephining operation over extraction for removal of diseased teeth.

Extraction of diseased teeth has never been a popular operation with the writer. To attempt to remove a molar in a young animal has always seemed an almost superhuman task. The attempt generally meets with a fracture of the tooth and a portion of the root being left in the aveolar cavity. Very often an abscess near the root remains to cause more trouble later. By trephining this is impossible, and with the introduction of conduction anæsthesia, the operation becomes relatively simple, and it is no longer necessary to resort to general anæsthesia.

A typical case came under my observation during May, 1925. This animal was owned by a medical officer, and was brought to the hospital on May 12th with quite a distressing line of symptoms. The animal was poor, ate every little, and was suffering from diarrhœa. An examination of the mouth revealed considerable caries of the right superior third molar. There was also some swelling in the region of the facial crest on that side. It was decided to trephine and repulse the affected tooth. The animal was prepared by casting in a lateral position with the English style hobbles. An area about three inches in diameter was clipped, shaved and disinfected above the facial crest. About 5 c.c. of 2 per cent. solution of procaine in 1/10,000 adrenalin solution was injected into the infra-orbital canal. The opening of the canal is not entirely superficial as it lies under the levator labii superiosis

* Reproduced from Vol. XIX., No. 5 of the U.S. Army *Veterinary Bulletin.*

proprius. In addition to this, procaine solution was injected subcutaneously in the entire field of operation. It was possible to inject the procaine solution into the gums directly adjacent to the diseased tooth by bending a long needle. A speculum was adjusted into the mouth and an incision was made through the skin and subcutaneous tissue just above the facial crest. Care must be taken not to go too high as there is some danger of injuring the infra-orbital nerve. The external maxillary artery and vein are found in this region but can be easily pushed aside with a blunt instrument. After removal of the periosteum, the bone was trephined and the tooth repulsed into the mouth. The anæsthesia used seemed to be perfect and the animal suffered no pain. In this particular case there was an abscess near the aveolar plate and some necrosis of bone. This was corrected after the tooth was removed.

The treatment consisted of daily irrigations and packing the cavity with oakum. This was continued until the gums had healed. The animal was returned to duty on June 29th, 1925, the opening having entirely closed. The diarrhœa stopped about a week following the operation, and the animal immediately began to improve in flesh.

Needless to say the owner is very enthusiastic over the operation, as he valued the animal very highly.

NOTANDA.

At the period of the Restoration, 1868, veterinary science, along with other sciences, was brought to Japan with the introduction of Western civilisation.

. . . . . .

That *B. pullorum* has a predilection for ovarian tissue of the hen is illustrated by the fact that these micro-organisms can be obtained from the ovary of hens that have been fed or inoculated with cultures of *B. pullorum*. (*Vety. Med.*).

. . . . . .

Approximately one thousand veterinarians are now employed full time in tuberculosis eradication in the United States.

. . . . . .

Lambs should be docked and castrated when they are from one to two weeks of age, and they should be weaned when they are about 4½ months of age.

. . . . . .

Cancer of the ear of sheep is of common occurrence in Australia and, according to Dodd, these neoplasms may be the result of irritation induced by identification marks or tags.

. . . . . .

Copper sulphate in ½ to 2 per cent. solution is destructive to snails. The use of 140 gallons of this solution per acre has been found to be quite an effective helicicide. Thus it may be possible to control liver fluke infestation, providing the cost for equipment, material, and labour does not exceed the value of the snail-infested land for pasture purposes. (*Vety. Med.*).

H.K.

REPORT.

City of Edinburgh.

REPORT OF THE CHIEF VETERINARY INSPECTOR FOR THE YEAR 1926.

This report has recently been issued in two parts—Part 1, dealing with the work carried out under the Diseases of Animals Acts and Orders, and

Part 2, dealing with the work carried out under section 4 (5) of the Milk and Dairies (Scotland) Act, 1914, and the Board's Circular Letter of 7th December, 1926. To this part is added an account of the year's work in connection with the inspection of meat and other foodstuffs, including port food inspection.

Mr. Arthur Gofton, the Chief Veterinary Inspector, is to be congratulated on this report, which, apart from very complete statistics, contains a large amount of very interesting material which is instructive to the practitioner as well as to those engaged in public administrative work.

In the report dealing with the work done under the Diseases of Animals Acts and Orders, one must appreciate the amount of work of a supervisory and preventative character which has been carried out in connection with the prevention of foot-and-mouth disease and sheep scab, from which diseases the City was fortunately free during the year 1926. The Sheep Dipping Regulations of the City continued in force, and 55,373 sheep were dipped under supervision. Mr. Gofton points out that the effort to control and eliminate sheep scab must fall on individual flockmasters, due to the fact that the disease is more frequently spread by sheep which have recently been in contact with infected sheep, and by sheep which harbour the parasite in a more or less latent condition. The summer months appear to favour this inactive condition and the winter months a recrudescence of activity with the appearance of clinical manifestations. During the latent period the sheep are frequently sold and mixed with other sheep and in consequence it becomes almost impossible to define the areas which might justifiably be called the "Nurseries of Sheep Scab."

The City was fortunate in escaping the introduction of foot-and-mouth disease. There was an outbreak in the County of Lanark and extensions therefrom into West Lothian. This outbreak was attributed to infection from fresh pig carcases imported from the Continent of Europe through the Port of Leith and thence consigned to Carluke and other centres. The importation of fresh pig carcases from the Continent was greatly on the increase. In 1924, 12,043 pig carcases were landed at Leith Docks, in 1925, 74,054 and from January to May, 1926, 48,946 carcases were landed. This trade was brought to a standstill when it was discovered that fresh pig carcases constituted a means by which the infection of foot-and-mouth disease was introduced from the Continent. Experiments carried out in Holland, and confirmed by the Foot-and-Mouth Disease Research Committee in Great Britain, brought to light the fact that the virus of foot-and-mouth disease retained its infectivity for very considerable periods in bone marrow—even for periods as long as 76 days. Arrangements were made at Leith Docks to carry out inspection for foot-and-mouth disease in respect of

each pig carcase subsequently imported from Europe and soon this inspection justified itself, in that on May 31st the s.s. "Schokland" discharged 271 pigs at Leith and unmistakable evidence of foot-and-mouth disease was detected in a number of carcases. This consignment was accompanied by a special certificate of freedom from foot-and-mouth disease, signed by an official of the public slaughterhouse concerned. As a consequence, the Ministry of Agriculture issued the Importation of Carcases (Prohibition) Order, which had the effect of prohibiting the import of carcases and of fresh uncured meat from the Continent of Europe.

The work of Mr. Gofton and his staff, in connection with the detection of foot-and-mouth disease in these carcases, was recognised by the Ministry of Agriculture and Fisheries in a special letter of thanks.

The City was free from any case of anthrax, rabies, swine fever and parasitic mange.

During the year, 14,683 Irish cattle were received at Georgie Cattle Markets. 2,536 Irish cattle and 99 Canadian cattle were moved to farms in the district of the Local Authority and were maintained under supervision during the required period of detention.

Under the Tuberculosis Order, 1925, 29 animals were dealt with in the City. Of these animals, 17 fell into the category of "Advanced" tuberculosis, and 12 were classified "Not Advanced"; five other animals were dealt with which were exposed for sale in Georgie Market. The necessity for an amendment of the classification laid down in the Order as between "Advanced" and "Not Advanced" tuberculosis, is pointed out. The distributions of the lesions of tuberculosis are subject to such a variety of combinations that it is difficult to find a form of words to differentiate between the two classes and it requires an inspector with a wide experience to deal with these cases.

PART 2.

No administrative difficulties were met with in working the Milk and Dairies (Scotland) Act, 1914, which came into force in September, 1925. 1,233 visits were made to registered Dairies and the cattle therein inspected. Apart from tuberculosis, 205 diseased cows were detected :—

Mastitis	114
Mammary abscess ...	3
Varicella	6
Mammary neoplasm ...	1
Actinomycosis of udder	1
Johne's disease	2
Psoroptic mange	42
General disorders ...	36

There are 195 licensed cowsheds with a cow population of 3,977 cows, in the City. The general standard of cleanliness in these sheds was very satisfactory.

During the year, 3,906 newly-calved cows were exposed for sale in the markets. Five of these cows were found to be affected with tuberculosis of the udder. Eight cows found affected with septic uterine conditions and 12 suffering from mastitis were withdrawn from the sale.

It is a pity that there were only eleven entries in the Clean Milk Competition which was carried through during the months January to June.

The very low bacterial counts of the winner are worthy of special note, since before plating the milk was in all cases retained at room temperature in a sealed bottle for 18 to 20 hours after collection.

No. of bacteria per c.c.	Coliform Organisms.
8,400	absent in 1 c.c.
2,200	do.
3,750	do.
7,050	do.
560	do.
1,130	do.

The work carried out by Mr. W. Jowett, F.R.C.V.S., D.V.H., the bacteriologist of the Department, is increasing. The remarks of such an authority on the coli content of pasteurised milk in relation to the efficiency of the pasteurisation deserve a closer study by all interested in the milk question. The following milk samples were submitted to bacteriological examination.

Ordinary market milk ...	25	samples.
Milk (Clean Milk Competition)	82	,,
"Certified" milk	54	,,
Grade "A" milk	33	,,
Pasteurised milk	21	,,

101 mixed milk samples collected at railway stations were examined biologically, and 11 were infected with tubercle bacilli. An interesting table is also given of the bacteriological examination of other materials. One point of note is that of the examination of the expectorates of 41 cows—20 being found to contain tubercle bacilli.

A very interesting case is reported of tuberculosis in a sheep, the causal organism was proved to be of the bovine type. There was one case of food poisoning which was proved to be due to the presence of a bacillus of the Gærtner group and its toxins.

Inspection of Meat and other Foods.

There were 184,464 animals slaughtered during 1926 :—

31,889 head of cattle.
4,818 calves.
133,272 sheep.
14,485 swine.

Dealing with condemned carcases, it is interesting to note that tuberculosis was responsible for 57.4% of the carcase seizures, and for 32.78% of the offal seizures.

46.5% of the cows slaughtered were affected with tuberculosis in some degree. The following table shows the comparison between tuberculosis and non-tuberculous diseases as causes of condemnation in carcases of animals slaughtered during 1926.

	Cattle.								
	Oxen.	Bulls.	Cows.	Heifers	Calves.	Total.	Sheep.	Swine.	Total.
Tuberculosis									
(Total) ...	31	1	151	8	7	198	1	32	231
(Partial) ...	124	5	326	14	2	471	—	56	527
Total & Partial ...	155	6	477	22	9	669	1	88	758
Non-tuberculous									
Diseases (Total)	10	–	36	–	14	60	225	32	317
Partial ...	47	3	42	1	4	97	107	40	244
Total & Partial	57	3	78	1	18	157	332	72	561

The percentage incidence of tuberculosis in animals slaughtered at the abattoirs during 1926 was :—

Cattle	Oxen	3·88	
	Bulls	15·33	8·79
	Cows	46·5	
	Heifers	7·89	
Calves			·24
Swine			5·15

In addition, 4,224 consignments of foodstuffs were inspected at the Port of Leith during the year.

ABSTRACTS.

On Tetanus in the Horse subsequent to Prophylactic Immunization ; with Observations on Re-vaccination.

A. T. MacConkey. *Brit. Jl. Exp. Path.* 1926. June. Vol. 7. No. 3. pp. 133-140. Ex *Trop. Vet. Bull.* March, 1927.)

The horse is so very susceptible to tetanus that it is difficult to avoid occasional cases in a stud at a serum laboratory. The risk may be minimised by (*a*) the regular injection of doses of tetanus antitoxin or (*b*) active immunisation with a series of doses of toxin guarded by a few doses of antitoxin. The occurrence of tetanus in horses treated in the latter way has raised doubts as to its effectiveness. Four horses received 1,500 U.S.A. units of tetanus antitoxin followed by 150,000 M.L.D. of toxin (for guineapig) subcutaneously. The doses of toxin were spread over nine days and given in increasing amounts.

Two of these were bled out one and two months later. One was used for other sera for 4½ years and shewed no evidence of tetanus. Three years after dosing its blood did not contain 1/100 unit of anti-toxin per cubic centimetre.

The fourth animal received a last dose of an immunisation on October 7th, 1924, and was bled for serum on October 14th. Ten cubic centimetres of serum of this bleeding did not produce the slightest evidence of tetanus in a guineapig. On October 21st there was evidence of tetanus, 16,000 units of antitoxin were given intravenously. The animal showed little sign of illness, except that it appeared to be fatigued until the fifth day, when it was found stretched at full length and showed occasional spasms.

A further 5,000 units of antitoxin were given. Two days later the animal was much worse and was shot. It is suggested that had more antitoxin been given the animal would have been saved, but it was thought that when the disease had been checked the animal's own antitoxin producing mechanism would have come sufficiently into play, it having been immunised by toxin at the beginning.

From tests made with the serum of this animal, at times it would appear that the antitoxin content fell very rapidly during the two months before death, when there was less than 1/100 antitoxic unit per c.c. It would appear that 1/100 unit is the limit of safety for the animal. Comparing the facts of the case with those reported by Mohler and Eichhorn, who found that 700 U.S.A. units given 96 hours after infection was enough to ward off an attack of tetanus, it would appear 16,000 units were not sufficient to prevent infection, which must have been in existence less than a week since the serum of a bleeding a week before caused no symptoms in a guineapig. This emphasises the necessity of giving antitoxin early. Another horse was given 1,500 U.S.A. units of tetanus antitoxin intramuscularly and this was followed by 390,000 M.L.D.'s of toxin distributed over eighteen days. At the time the penultimate dose of 100,000 M.L.D.'s was given, 2,000 U.S.A. units of antitoxin were given intramuscularly.

About ten months later this horse was given a dose of scorpion venom and ten days later symptoms of tetanus were noticed. 20,000 U.S.A. units of antitoxin were given at once intravenously, and a further 20,000 on the following day. The symptoms appeared to be passing off and the animal was feeding well, when on the fifth day after the second dose he dropped dead from internal hæmorrhage. Examination of sera of a number of horses at different periods after prophylactic immunisation showed that they varied in their response to prophylactic treatment as much as they do to the more prolonged immunisation necessary for the production of therapeutic sera and that a certain dose of toxin cannot be relied upon to produce a certain antitoxin immunity. An increase in the amount of toxin does not necessarily cause an increase in the amount of antitoxin produced.

A further point is the possibility, as suggested by the work of Tenbroeck and Bauer, that an antitoxic immunity may not necessarily protect against infection. Animals that have recovered from severe generalised tetanus show practically no antitoxin in their blood, but are immune to the type of organism which produced the original infection. It might be suggested that the horses were infected with a type of tetanus bacillus other than that against the toxin of which they were immunised. This is contra-indicated by the fact that more than eight strains of bacilli are always used for the preparation of the toxin for immunising purposes.

It appears to be clear that the limit of antitoxin immunity is about 3½ years, and consequently re-vaccination should be practised every 3 or 4 years.

Details are given of the process of re-immunising two horses and the tests of their serum at intervals during the process.

The first animal's serum contained less than 1/100 antitoxin unit per c.c. The process of re-immunisation was, therefore, begun with 1,500 U.S.A. units of antitoxin intramuscularly ; it then received on alternate days 15,000, 25,000 and 40,000 M.L.D.'s (for guineapigs) of toxin. By this time the serum contained 1/50 antitoxin unit per c.c. Then a further 1,500 antitoxin units were given intramuscularly, and these were followed on alternate days by 40,000, 70,000, and 100,000 M.L.D. of toxin. At this stage the serum contained more than 3 but less than 5 units per c.c.

The toxin injections were continued with 100,000, 150,000, and 250,000 M.L.D., after which the antitoxin content of the serum was more than 10 but less than 20 units per c.c. The second animal had, at the time of re-vaccination, 10 units per c.c. ; antitoxin was therefore not injected and doses of 15,000, 25,000 and 40,000 M.L.D. were given with intervals of two days later. On the fourth day after the last dose the antitoxin content was between 30 and 50 units per c.c.

Ephedrine Hyperglucæmia in Dogs and Rabbits.

Ephedrine sulphate, injected intravenously or subcutaneously in doses of 10-15 mgm. per kilo., produces a definite increase in the blood sugar in dogs. The response to similar doses, in rabbits, is less uniform and generally less marked. Definite elevation of the blood sugar concentration is, however, found following intravenous injection of doses ranging from 20 to 30 mgm. per kilo. Very rough comparisons indicate that doses of ephedrine, very much stronger than those used to produce effects comparable to the clinical action of adrenalin, have a much less marked effect on blood sugar than adrenalin injections. J. A. Wilson (*J. Pharmacol.*, 1927, XXX, 209).

Complex Composition of Glandular Secretions.

The specific action of certain hormones is due not to a single constituent, but to the combined action of several definite substances. Thus, the author claims to have isolated three distinct crystalline principles from insulin. One of these reacts on the glycosuria and glycæmia of diabetics, but has only a slight action on healthy subjects. The other has a strong hyperglycæmic action. The third has not yet been investigated. From the posterior lobe of the hypophysis he has isolated five distinct crystalline substances. None of these, used alone, has any action on the guineapig uterus; when administered together in definite proportions the mixture has the characteristic action on that organ. C. Funk (*L' Union Pharm.*, 1927, LXVIII, 80).

Changes in the Organism caused by Cod-liver Oil added to the Food.

The author investigated post-natal development in animals under varying conditions of function and nutrition. The clinical changes observed after administration of cod-liver oil varied widely with the individual animal. In calves doses of from 0·6 c.c. to 1·6 c.c. per kilo. of body weight generally produced apathy, diarrhœa, polyuria, eczema and cardiac affections, and in some cases pathologic changes in the lung. Functional disorders of the heart were found in cats and dogs from doses as small as 0·4 c.c. of cod-liver oil per kilogram of body weight. The poisonous effect of cod-liver oil was greatly influenced by the composition of the basal diet and especially by its content of vitamins B and C. In addition to good basal diet, warm weather and sunshine seemed to diminish the poisonous effects of the oil on the organism. E. Agadur (*Acta Poediat*, 1926,VI, 163, through *J. Amer. Med. Assoc.*, 1927, LXXXVIII, 1124).

Relation of Vitamin E to Iron Assimilation.

The function of vitamin E, which was first noted to occur in the fatty oil of the wheat germ, is in some manner associated with iron assimilation. The sterility in rats fed on diets deficient in this vitamin is due to a crisis in their Fe assimilation, which can be obviated by providing the vitamin E in appropriate amounts from the beginning of pregnancy. $FeSO_4$ is harmful to rats when included in the diet in amounts as small as 0·2 per cent. of the food mixture. It does not serve as a satisfactory source of Fe for the rat, and when a salt mixture is employed as the sole source of Fe in the diet, the animals ultimately reach a condition which is followed by a speedy decline in weight, marked enfeeblement, and, in most animals, the development of ophthalmia, which has been designated as "salt ophthalmia." There are two ways in which rats can be caused to recover from this crisis. One is by giving them wheat germ oil, and the other is by replacing the $FeSO_4$ of the diet by ferric citrate. Ferric salts are far superior as a source of Fe to growing rats than are any ferrous salts yet examined. Liver fats contain vitamin E in considerable amounts, and liver contains much Fe. The special value of liver in the diet recommended by Minot and Murphy lies in its content of vitamin E and of Fe. The authors' work offers a new interpretation for certain experimental data of other investigators who have attributed pernicious anæmia to lack of vitamin A, and suggests a new point of view in interpreting the cause of sterility attributable to faulty nutrition. Nina Simmonds, J. E. Becker, and E. V. McCollum (*J. Amer. Med. Assoc.*, 1927, LXXXVIII, 1047).

Comparative Growth-promoting Activity of Irradiated Fat, Irradiation, and Cod-liver Oil.

Irradiated fat in the diet and direct irradiation possess to about the same degree the power to promote gain in weight of rats on a diet deficient in both fat-soluble vitamins A and D. This power is less than that of cod-liver oil, which possesses the growth-promoting property to a far greater degree than either direct irradiation or irradiated oil. Radiant energy, administered directly or indirectly, does not prolong the life of rats on a diet deficient in viatmins A and D, and does not prevent them from developing xerophthalmia. H. Goldblatt and A. R. Moritz (*J. Biol. Chem.*, 1926, LXXI, 127-37 (through *Chem. Abstr.*, 1927, XXI, 435).

Parathyroid Extract for Haemorrhage.

Parathyroid extract was administered to a series of 347 patients with hæmorrhage from various causes. Cessation occurred in 304 patients following one or more transient increases in the calcium content of the circulating blood. The most favourable results followed the administration of from ten to fifteen units every thirty-six hours for one to three doses. As a preoperative measure in jaundice, it reduced the coagulation time to within normal limits and apparently prevented hæmorrhage. The unfavourable results occurred when over-dosage and prolonged administration were employed. In addition, unfavourable results occurred in blood dyscrasia (puerperal hæmorrhage and hæmorrhagic disease of the new-born) irrespective of the size and number of doses, apparently because of certain local changes in the tissues. As compared with the common experiences with oral and intravenous administration of calcium the results are more dependable and, furthermore, gastric irritation and other untoward effects are avoided. The hormone was found to be of special value in patients recovering from surgical operations who were unable to tolerate oral therapy. The use of parathyroid extract is suggested as a means for controlling hæmorrhage because it effectively mobilises calcium salt, which is normally stored in the body and which is necessary for clotting. B. Gordon and A. Cantarow (*J. Amer. Med. Assoc.*, 1927. LXXXVIII, 1301).

Veterinary Medical Association of Kenya Colony and Protectorate.*

MEETINGS HELD AT KABETE LABORATORY.

The second annual general meeting of the above Association was held at Kabete Laboratory, on December 29th, 1926.

The President (Lieut.-Col. A. G. Doherty) occupied the chair, and the following Fellows and Members also signed the attendance book : Messrs. Scott Little, W. G. Emerson, E. J. Mulligan, R. L. Creery, R. C. Wheeler, J. Walker, R. Daubney, J. T. C. Bradshaw and S. H. Whitworth.

The minutes of the first general meeting were read and confirmed.

The President, in his report, spoke as to the assistance given to the Profession, not only locally, but generally, by the formation of the Association.

The Hon. Treasurer (*pro tem*) submitted the accounts of the Association in the Ledger, as handed over temporarily by the Hon. Treasurer, who was on leave in England.

The accounts were accepted by the meeting.

The adoption of Rule 34, as altered at the Special General Meeting was proposed by Mr. Daubney, seconded by Captain Scott Little, and unanimously approved.

It was proposed by Mr. Bradshaw, seconded by Captain Wheeler, and unanimously agreed, that the Officers of the Association should remain as those of the previous year.

A proposal that the members Messrs. G. Scade and F. R. Hale be elected Fellows was carried with acclamation, as was the proposal to elect Mr. J. R. Hudson as a member.

OSWALD DIXON, *Hon. Secretary (pro tem.)*

At the same place and on the same date the third ordinary general meeting of the Association was held.

The President was in the chair, and the following Fellows and Members signed the attendance book : Messrs. Scott Little, W. G. Emerson, A. G. Doherty, E. J. Mulligan, R. L. Creery, R. C. Wheeler, J. Walker, R. Daubney, J. T. C. Bradshaw, S. H. Whitworth, G. Scade and J. R. Hudson.

The minutes of the second ordinary general meeting were read and confirmed.

Mr. Daubney showed a specimen of a bladder from a cow from the Limoru area, suffering from persistent hæmaturia. This animal made a natural recovery at the laboratory, but died later from gastritis.

The President gave a brief history of this disease in the Limoru area. Bracken poisoning was suggested. Mr. Walker proposed that feeding experiments should be carried out.

Messrs. Bradshaw, Mulligan and Emerson joined in the discussion.

Mr. Daubney amplified his paper, "Paratyphoid (Salmonella) Infection of Calves in Kenya," which had been circulated and taken as read, with charts, chemico biological tests, etc. [Mr. Daubney's paper appears at the commencement of this issue of the *Record*.—Ed.].

OSWALD DIXON, *Hon. Secretary (pro tem.)*

* Received on August 22nd, 1927.

NOTES AND NEWS.

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events.

Sept. 19th.—Meeting of the Editorial Committee N.V.M.A., 10 Gray's Inn Square, at 4-30 p.m.
Sept. 22nd, 23rd.—Examination at R.C.V.S. for Jubilee Memorial Bursary.
Oct. 5th—R.C.V.S. Committee Meetings.
Oct. 6th—R.C.V.S. Committee Meetings.
Oct. 7th –R.C.V.S. Council Meetings.

ROYAL VETERINARY COLLEGE APPOINTMENTS.

At a meeting of the Governors of the Royal Veterinary College, held on Friday, September 9th, the following appointments were made additionally to those announced in our last week's issue : Professor James Macqueen, F.R.C.V.S. was elected to the office of Dean, and Dr. Tom Hare, M.D., B.V.Sc., M.R.C.V.S., of the Lister Institute of Preventive Medicine, London, was appointed to the Chair of Pathology.

The following gentlemen have been appointed Assistant Veterinary Inspectors to the County Council of the West Riding of Yorkshire :—

W. T. MacGregor, M.R.C.V.S. (Dunoon) ;
J. G. Ross, M.R.C.V.S. (Linlithgow) ;
R. S. Smyth, M.R.C.V.S., D.V.S.M. Vict. (Dublin) ;
S. B. Vine, M.R.C.V.S. (Settle).

Women students are to be admitted to the Royal Veterinary College, Camden Town, London. Complete courses of instruction will be given for the Diploma of the Royal College of Veterinary Surgeons (M.R.C.V.S.). Classes will begin on Tuesday, 4th October, and applications for the admission of women students will be received at the College.

PERSONAL.

Mr. F. Bullock's bereavement. We regret to learn the news of the death of Mrs. Salmond, the mother of Mrs. Fred Bullock, which took place at Crouch End, on Tuesday, the 6th instant. Mr. and Mrs. Bullock were spending a holiday in France and were recalled by telegram in time to watch over the deceased lady during her last few days. The funeral took place at Banktoot, in Perthshire, on Saturday, the 10th instant. Our sincere sympathies go out to Mr. and Mrs. Bullock and family in their sad bereavement.

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Wili. Mr. Robert Cadwallader Trigger, of Newcastle-under-Lyme, veterinary surgeon, a past president of the Council of the Royal College of Veterinary Surgeons, who died on June 19th, aged 78, left £43,833, with net personalty £39,553. He left :—
£250 to the Wolverhampton Royal Orphanage ; £250 to the Churchwardens of the Parish Church of St. Giles',

Newcastle-under-Lyme, for the repair of the fabric; £150 to the Victoria Veterinary Benevolent Fund; £100 to the Newcastle-under-Lyme Free Library Committee; and £100 to John Boughey, groom, if still in his employ.

"Veterinary Philosophy."

The word "Veterinary" is utilised in a manner possibly unique (in its connection as given above) by Dr. Bertram Lee Woolf, who employs this heading for a criticism (appearing in the September 1st issue of the *Christian World*), on Sir Arthur Keith's address as President of the British Association. In his opening paragraph Dr. Woolf says:—"The address delivered by Sir Arthur Keith, as President of the British Association, at Leeds last night professed to be a simple account of anthropological research up to the present date. But from the author of 'The Religion of a Darwinist' one naturally looked for some reference to the religious implications of the subject. The opening and somewhat jubilant review of the mid-Victorian battle between science and religion raised one's hopes, but he passed on to show proof once more for the common ancestry, in far-off ages, of man and the anthropoid apes. The point is, of course, now scarcely worth debating. But when he went to considerable pains, though with strangely loose phraseology, to prove the essential identity of result in both man and ape, only the few surviving hard-shelled Haeckelians could possibly accept his case. And one may fairly ask whether Sir Arthur himself would "pass" a medical student who confused a human cæcum with that of a gorilla, or even a baby's brain with that of a chimpanzee, and whether he is prepared to divide mankind into (say) the white, yellow, red, brown, black and hairy races."

Foot-and-Mouth Disease.

"Foot-and-Mouth disease has broken out afresh in Bedfordshire, after the destruction last Saturday of ninety-nine animals at Kempston," says *The Times* of September 9th. "The new outbreak was notified on Tuesday on a farm the property of Mr. C. J. Goode, of Houghton Conquest, and thirty-two cattle, seventy-eight sheep, and fifteen pigs have been slaughtered and burned by order of the Ministry of Agriculture. The Ministry have established a local office in Bedford, and are trying to trace each of 2,300 animals which were sold at Bedford Sheep Fair last week, when the disease was first notified.

"Contact with the Kempston outbreak has been established through the Bedford Sheep Fair, where Mr. Goode purchased a few head of sheep which had been in contact with the affected animals. Most of the animals, it is stated, went to farms within the existing fifteen-mile area declared by the Ministry, and, although several head of sheep went farther into the country, it is hoped to confine the outbreak to the original area. The roads in both areas affected have had to be closed, and the police are applying the usual stringent precautions as regards access to the farms.

"It is feared that Luton market will now have to be closed through this fresh outbreak, as it is within the fifteen-mile radius of Houghton Conquest. Consequently the two principal cattle markets in the county will be closed and farmers will have their stocks on their hands. In any case they can only be moved under permit. Bedford market itself has been closed for twenty-eight days."

Army Veterinary Service.

London Gazette—War Office—Regular Forces.

Sept. 9th.—Major D. E. Orr resigns his commission, and is granted the rank of Captain (Sept. 10th).

Militia.

Supplementary to Units or Corps.

Royal Army Veterinary Corps.

Captain P. B. Riley, on appointment to the Ind. Aux. Force, relinquishes his commission (Oct. 10th, 1922), and is granted the rank of Major. (Substituted for the notification in the *Gazette* of August 14th, 1923).

Research at the Zoo.

The Zoological Society has lost both its Anatomical and its Aquarium Research Fellows, and the posts will be filled before the end of the year.

On the death of Dr. Sonntag in 1925, the Council decided to transform the post into a research Fellowship, tenable for a limited number of years, in the hope of securing ambitious young anatomists who would desire to devote themselves for two or three years to research on the rich material for comparative anatomy available in the Prosectorium, before passing to professional work at a medical school or university. It was arranged, moreover, to allow the Anatomical Fellow to combine his work at the Zoo with a certain amount of teaching at a London medical school, in order that he might keep in touch with professors and students. Dr. John Beattie, a graduate in honours of the University of Belfast, was appointed from a number of candidates as the first Anatomical Fellow and was attached to University College as well as to the Zoo. During his tenure, which began with 1926, he has published a number if valuable papers on vertebrate anatomy, and has just been appointed assistant Professor of Human Anatomy in the University of Toronto.

The Aquarium Research Fellowship was instituted in the end of 1924 to give an opportunity for such investigations into the conditions of aquatic life as could be conducted in the aquarium, where a laboratory and research tanks had been provided. It was decided that the first Fellow should devote himself specially to the chemical and physical conditions in the aquarium plant, so as to lay a firm foundation for biological inquiries. The first Fellow, Dr. F. P. Stowell, was a graduate in honours in chemistry of the University of Liverpool and began his work at the Zoo in 1925. He also has published a number of papers of great value not only to the management of the aquarium, but as additions to scientific knowledge. His tenure of the Fellowship would have ceased at the end of this year, but he has received an appointment as research chemist to a large manufactory and left at the beginning of this month to assume his new duties. It is intended that his successor in the Fellowship should take up a biological line of investigation.—*The Times.*

Improving the Milk Supply.

In the Section of Agriculture, at the recent meetings of the British Association, Dr. Ruston (Leeds University) pointed out that quite apart from the vital importance to our population of adequate supplies of pure milk, the product itself was shown by Ministry of Agriculture returns to be by far the most valuable of our agricultural productions. The yearly output was valued at £56,000,000, which is five times that of potatoes and nearly twice that of beef.

Examination of records going back to 1908 on Yorkshire farms showed that the total cost of the food bill for cows was the largest single factor, amounting to 2s. 3d. of the total cost of producing the milk. This must receive more attention and research if economies in cost of production were to be secured.

At the same time the financial position of the milk farmer was equally dependent on his ability to dispose of the milk to its best advantage. There was a distinct tendency for progressive milk producers to undertake their own distribution, especially of certified and graded milk, in the attempt to obtain a better profit than that secured when the milk was sold direct to wholesalers. There was, further, evidence that the conversion on the farm or in local centres of milk into butter, cheese, etc., was being reduced in favour of direct sales of raw milk to consumers.

The Editor acknowledges the receipt of the following:—

Report of a meeting of the North of Scotland Division, from Mr. J. McAllan, Hon. Secretary.

Communications from Dr. W. H. Andrews (Weybridge), Messrs. J. M. Buchanan (Glasgow), A. New, R. A. S. Macdonald, and G. Wilson (Belfast).